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DCOR, LLC

Discharge Alternatives Study

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Discharge Alternatives Study

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Discharge Alternatives Study

1.1 Background

On December 1, 2004, General Permit No. CAG280000 authorized discharges under the National Pollutant Discharge Elimination System for oil and gas exploration, development, and production activities located in the Pacific OCS. Each discharger under the General Permit is required within two years of the effective date to submit to the EPA a study or studies to determine the feasibility, as defined in the California CMP, of disposal of drill muds and cuttings and produced water by means other than discharge into the ocean.

DCOR, LLC (DCOR) acquired nine (9) Pacific OCS Platforms from Plains Exploration & Production Company (PXP) on December 1, 2004. The following platforms were acquired in 2004 and the discharges from these facilities are the subject of this study: Platforms Habitat, Gina, Gilda, A, B, C, Hillhouse, Henry, and Edith.

1.2 Study Objectives

As part of General Permit CAG280000 Section II G.6(b) DCOR is required to submit a Discharge Alternatives Study for Platforms Habitat, Gina, Gilda, A, B, C, Henry, Hillhouse, and Edith. This study has been generated by DCOR staff in coordination with other industry representatives.

DCOR will determine the feasibility of disposal of produced water and drill muds & cuttings by means other than discharge into the ocean. This will be a platform by platform analysis. The study will include a platform–by–platform analysis of the continued feasibility of reinjection of produced water for those platforms that reinject produced water, and those platforms which do not discharge produced water. Furthermore, this study includes a platform–by–platform analysis of potential drilling mud & cuttings to be generated over the next five years and alternatives to discharging this material overboard.

Three major study objectives were formulated, including: (1) generate alternatives to produced water discharges; (2) generate alternatives to drilling muds & cutting discharges; (3) determine feasibility of each discharge alternative.

1.3 Definitions

Feasible — Coastal Management Act Section 30108: "Feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.

1.4 Study Approach

To meet the objectives previously cited, DCOR used the following methods: (1) a series of meetings to discuss platform specific details (geologic, facilities, volumes, discharges, power, fluids, regulatory requirements, etc.); (2) a series of site visitations, contacts via telephone & email to verify specific platform details; (3) a review of available in house reports and data.

1.5 Platforms, Discharges, & Alternatives

Analyses for each of the following platforms follows:

Platform Habitat
Platform Gilda
Platform Gina
Platform A
Platform B
Platform C
Platform Hillhouse
Platform Henry
Platform Edith

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Discharge Alternatives Study for Platform Habitat

Location: Latitude – 34° 17' 11.8" N and Longitude – 119° 35' 17.1" W
Nearest County — Santa Barbara
OCS #: P 0234

I. Produced Water

Platform Habitat discharges about 540 BBL/day or 197,100 BBL/year. The platform is authorized to discharge 4500 BBL/day or 1,642,500 BBL/year. The current discharge is about 12% of the maximum limit. Future discharge from this facility will most likely increase to a level of 24% of the current maximum limit.

Discharge	Average [1]Historic Discharge (BBL/Day)	Average Expected Discharge (BBL/Day)	[2]Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	540	1000	**197,100**	**1,642,500**	0	0

The following alternatives have been considered for injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Re–injection	Drill well, [3]Optimization, Facilities, Operations	Air, Regulatory	No change	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities
Pipeline	Trucking , Facilities, Disposal	Air, CUP, Waste	Health, Traffic, Visual & Noise, Political	Facilities

A. Re–injection of Produced Water:

1. Economic
   a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.

[1] Average is cumulative annual discharge/ 365
[2] December 2005 to November 2006
[3] Reconfigure and/ or chemically treat existing injection well or convert existing producer

b. Optimization – Optimization of existing injection wells and conversion of producing wells to injection will range from $400,000– $800,000.
c. Facilities – Cost of additional facilities is estimated at $10–$25,000.000. Additional deck space is needed for tank(s). Increase in pump capacity needed and entirely new water separation facility.
d. Operations – $/bbl charge will increase lease operating expense.

2. Environmental/ Regulatory
    a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities. If the increase of emissions is not considered *de minimus,* offsets would be required.
    b. Regulatory – Permits to start a water flood or disposal well would be needed. There are no approved water injection wells for this facility. In addition, a modification to the DPP as well as approval from the MMS would have to be obtained since the original DPP did not allow for water flooding or water disposal into this reservoir.
3. Social
    a. No Change.
4. Technical
    a. Geologic – The flowing gas completions at their current configuration require a minimum flow of gas to lift the increasing water production out of the well. If the flow is not enough gas production stops. This happens at about a 900 Mscf/D rate on each well. Since the reservoir consists of highly pressured laminated gas and water sands, several factors contribute to the wells gas production demise. First, each wells water production varies depending on how many and when each gas sand goes wet, second, the amount of pressure depletion within each producing gas sand and lastly, how many water sands are contributing to production at that time.
    b. Power Supply – Current load is 233 kVA and additional available shore power is 2750 kVA.
    c. Facilities – The platform was designed for a flowing gas field with little or no water production. Because of this deck space was not considered for additional facilities for handling water. A project of this scope would require structural loading analysis of the platform before facilities could be considered.

B. Barging:
Scenario includes a permanent storage barge at the facility plus a transportation barge and tug (transportation barge and tug cost shared by each facility based on proportion).

1. Economic
    a. Purchase/Rent Barges – Facility would need a permanent 5,000 BBL barge. Estimated cost for purchase of barge is $105,000 and rental is $1,000/ day. Estimated cost of barge (40,000 BBL) and tug is $6,000/day of which Platform Habitat would be charged $170/ day. Additionally fuel cost is $115/day.
    b. Trucking – The volume of fluids would require 9 trips per day with an estimated cost of $3,360/ day.
    c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
    d. Disposal – Cost of disposal would be $5.50 BBL at a total daily cost of $5,500/ day.
2. Environmental/ Regulatory
    a. Air – Increased air emissions from tug operations only would generate NOx 678 lbs/year, HC 17 lbs/year, PM 8 lbs/year, and CO 66 lbs/year. This includes the use of one tug making one round trip each day. Additional increases would come from the permanent barge, transportation barge, and trucking.
    b. Waste – Sanitary waste and operational waste (tug).
    c. Mooring – Obtain mooring permit.
    d. Permit approval – Modify development and production plan
    e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (7 round trips per week; 365 trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
    a. Health – Increased air emissions in non-attainment area.
    b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic (75 round trips per day).
    c. Visual – New barge located next to Platform Habitat (140 x 42 x 7). Tug and barge traveling through the Santa Barbara Channel daily.
    d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.

4. Technical
    a. Facilities – Space available for docking barge at Port Hueneme. Space for trucking would be needed at Port Hueneme.

C. Pipeline:

1. Economic
    a. Trucking – The volume of fluids would require 9 trips per day with an estimated cost of $3,360/ day.
    b. Facilities – An onshore facility would have to be designed and installed to take Habitat water. No onshore facility exists at this time. It is estimated that an onshore facility may cost in excess of $25,000,000. Only one pipeline comes to shore which would require gas conditioning equipment onshore to reduce water dew point of gas before sales.
    c. Disposal – Cost of disposal would be $5.50 BBL at a total daily cost of $5,500/ day.
2. Environmental/ Regulatory
    a. Air – Increased air emissions from additional components, tanks, and trucking.
    b. Local CUP would be required for construction of onshore facility.
    c. Air permit required for onshore facility.
    d. Waste – Tank cleanings and chemical waste.
3. Social
    a. Health – Increased air emissions in non-attainment area.
    b. Traffic – Increased vehicle traffic (9 round trips per day) in the City of Carpinteria, Hwy 101 and Hwy 126.
    c. Visual and Noise – Increased traffic along Hwy 101 and Hwy 126.
    d. Political – Oil and gas operations increasing traffic and emissions in the Ventura area.
4. Technical
    a. Facilities – Space limited for extra storage tanks. No deck space for additional equipment. No onshore facility or gas conditioning equipment.

D. Produced Water Conclusion:

Implementing water injection will not be feasible due to the following factors:

1. Costs of additional facilities are in excess of $10,000,000 and may be as much as $25,000,000. Drilling one additional injection well would cost as much as $4,000,000. Optimization of one injector or producer would cost as much as $800,000. Total capital cost could be in excess of $25,800,000.

2. Modification of DPP would be required. It is highly unlikely such an approval would be granted given the sensitivity of the reservoir to more water.
3. Introducing injected water back into the reservoir may cause an increase in water production from water bearing sands. Ultimately this may cause damage to production wells.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $476,930/ year. Trucking and disposal costs would be approximately $3,233,900/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.

Pipelining produced water is infeasible due to the following factors:

1. Trucking and disposal costs would be approximately $28,233,900/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Acquiring space and CUP approval within the City of Carpinteria unlikely.

II. Drilling Muds & Cuttings

Platform Habitat could drill up to five (5) wells over the next five years. Each well could potentially generate 600 BBL of drilling muds and cuttings. This would be a total of 3,000 BBL of drilling muds & cuttings over the next five years (or 600 BBL/year). This is approximately 0.5% (one half percent) of the maximum permitted limit.

Discharge	Historic Discharge (BBL)	[4]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[5]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	3,000	0	137,500

[4] Expected over the next five years

[5] Includes muds, cuttings, & cement (see NPDES permit for breakdown).

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	**Environmental/ Regulatory**	**Social**	**Technical**
Injection	Drill well, [6]Optimization, Facilities	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Regulatory, Mooring, Spills	Health, Traffic, Visual, Political	Facilities

A. Injection:

1. Economic
   a. Drill Well – Cost of injection well would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
   b. Optimization – To convert existing producer or injector to disposal well would cost $1,500,000 to $2,000,000.
   c. Facilities – Rental of slurification facility would be $7,000/ day. Duration of drilling varies; however, it can typically last from 45 to 90 days.
2. Environmental/ Regulatory
   a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
   b. Agency review and approval required prior to drilling disposal well.
3. Social
   a. No change.
4. Technical
   a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug any permeable formation suitable for waste disposal.
   b. Power Supply – Current load is 233 kVA and additional available shore power is 2750 kVA.
   c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

[6] Converting existing injector or producer into disposal well

B. Barging:

1. Economic
    a. Purchase/Rent Barges – Facility would need a project dedicated 1,000 BBL barge. Estimated cost for purchase of barge is $150,000 and rental is $500/ day. Estimated cost of tug is $6,000/day.
    b. Trucking – The volume of fluids would require 5 trips per well with an estimated cost of $3,600.
    c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
    d. Disposal – Cost of disposal would be $1,500 per truck. This includes solidification and disposal.
2. Environmental
    a. Air – Increased air emissions from tug operations would generate NOx 22 lbs/well, HC 0.50 lbs/well, PM 0.26 lbs/well, and CO 2 lbs/well. This includes the use of one tug making one round trip at the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.
    b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate one additional waste, wash down water, from cleaning the barges and any containers used in transport. The waste water will have to be disposed of in a permitted facility.
    c. Regulatory – Modification to DPP may be required.
    d. Mooring – A mooring permit may be required.
    e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
    a. Health – Increased air emissions in non-attainment area.
    b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
    c. Visual – New barge located at platform during drilling activities. Tug and barge traveling through the Santa Barbara Channel during drilling activities.
    d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.

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4. Technical
   a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge. Positioning of barge relative to platform would need to be stable.

C. Drilling Muds & Cuttings Conclusion:

Injection of muds & cuttings will not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.
5. Modification of DPP may not be approved for gas reservoir.

Barging drilling muds & cuttings is infeasible due to the following factors:

1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:

1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995).

2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.
3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

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Discharge Alternatives Study for Platform Gilda

Location: Latitude – 34° 10' 56.4" N and Longitude – 119° 25' 6.0" W
Nearest County — Ventura
OCS #: P 0216

I. Produced Water

Platform Gilda discharges about 5,000 BBL/day or 1,825,000 BBL/year. The platform is authorized to discharge 69,863 BBL/day or 25,500,000 BBL/year. The current discharge is about 7.15% of the maximum limit.

Discharge	Average [1]Historic Discharge (BBL/Day)	Average Expected Discharge (BBL/Day)	[2]Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	5,000	5,000	1,825,000	25,500,000	0	0

The following alternatives have been considered for ongoing injection of produced water and injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Re–injection	Drill well, [3]Optimization, Facilities, Operations	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment
Pipeline	Trucking , Facilities, Disposal	Air, Waste	Health, Traffic, Visual& Noise, Political	Trucks, Equipment

A. Re–injection of Produced Water:

1. Economic
   a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
   b. Facilities – Cost of additional facilities is estimated at $500,000. Dedicated on-board separation facilities would be required. Additional deck space may need to be created to accommodate the

[1] Average is cumulative annual discharge/ 365
[2] December 2005 to November 2006
[3] Reconfigure and/ or chemically treat existing injection well or convert existing producer

new separation facilities and additional pumps. Increase in pump capacity would be needed.
   c. Operations – $/bbl charge will increase lease operating expense.
2. Environmental/ Regulatory
   a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities. If the increase of emissions is not considered *de minimus*, offsets would be required.
   b. Regulatory– Modification of the DPP for operations would not be needed. MMS approval would be required for conversion and drilling.
3. Social
   a. No Change.
4. Technical
   a. Geologic – Gilda produces from three separate reservoirs: Upper Repetto, Lower Repetto, and Monterey. The platform currently has a peripheral waterflood in place in the Upper Repetto, using sea water. The current injection scheme is experiencing breakthrough problems in first and second line producers. Increasing water injection capacities will likely increase cycling of water between injector and producer wells. It would also result in over pressuring the reservoir, which could result in well control problems when working on wells. The Lower Repetto is much tighter than the Upper Repetto, resulting in a greater likelihood of face plugging if injection were attempted. The fractured nature of the Monterey formation carries a high permeability. It is likely that any water injected would immediately cycle to a nearby producer and kill the oil production.
   b. Power Supply – Current load is 1000 kVA and additional available power is 3950 kVA.
   c. Facilities – To conduct produced water disposal, additional water handling equipment, such as dedicated on-board separation facilities and additional pumps, would have to be installed. Platform deck space is limited and deck loading would have to be reviewed.

B. Barging:

Scenario includes a permanent storage barge at the facility plus a transportation barge and tug (transportation barge and tug cost shared by each facility based on proportion).

1. Economic
   a. Purchase/Rent Barges – Facility would need a permanent 10,000 BBL barge. Estimated cost for purchase of barge is $1480,000 and

rental is $1,500/ day. Estimated cost of transport barge (40,000 BBL) and tug is $6,000/day of which Platform Gilda would be charged $835/ day if all other platforms were also barging water. Additionally fuel cost is $560/day.

   b. Trucking – The volume of fluids would require 42 trips per day with an estimated cost of $15,700/ day.
   c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
   d. Disposal – Cost of disposal would be $5.50 BBL at a total daily cost of $27,500/ day.
2. Environmental/ Regulatory
   a. Air – Increased air emissions from tug operations only would generate NOx 678 lbs/year, HC 17 lbs/year, PM 8 lbs/year, and CO 66 lbs/year. This includes the use of one tug making one round trip each day. Additional increases would come from the permanent barge, transportation barge, and trucking.
   b. Waste – Sanitary waste and operational waste (tug).
   c. Mooring – Obtain mooring permit.
   d. Permit approval–Development and Production Plan would not need to be modified.
   e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (7 round trips per week; 365 trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic (42 round trips per day).
   c. Visual – New barge located next to Platform Gilda (195' x 35 x 10'). Tug and barge traveling through the Santa Barbara Channel daily.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Space available for docking barge at Port Hueneme. Space for trucking may be limited. Increased traffic to Port Hueneme may be limited.
   b. Equipment limitations – Limited vacuum trucks.

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C. Pipeline:

1. Economic
   a. Trucking – The volume of fluids would require 42 trips per day with an estimated cost of $43,200/ day.
   b. Facilities – Additional facility modifications would be required at the onshore facility. The major item would be an additional produced water storage tank for Gilda. Cost for an additional tank would probably exceed $100,000, but the cost is immaterial because there is no room for such a tank at the Mandalay Onshore Facility, where the pipeline comes ashore, and no way to expand the size of the facility. Additional costs of facility modifications for a loading facility would be required, if it were possible to store the additional water.
   c. Disposal – Cost of disposal would be $5.50 BBL at a total daily cost of $27,500/ day.
2. Environmental/ Regulatory
   a. Air – Increased air emissions from additional components, tanks, and trucking.
   b. Waste – Tank cleanings and chemical waste.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic – Increased vehicle traffic (42 round trips per day) on Port Hueneme and Oxnard city streets, Hwy 101, and Hwy 126.
   c. Visual & Noise – Increased traffic along Port Hueneme and Oxnard city streets, Hwy 101, and Hwy 126.
   d. Political – Oil and gas operations increasing traffic and emissions in the Ventura County area.
4. Technical
   a. Facilities – There is a 4000 BBL produced water storage tank at the Mandalay Onshore Facility; and it is used to process the produced water for two platforms (Gilda and Gina). As noted under economics, there is no space for extra storage tanks. Space limited for trucks.
   b. Equipment limitations – Limited numbers of vacuum trucks available.

D. Produced Water Conclusion:

The ongoing injection of water at the current rate seems feasible for the near future. However, increasing the water injection rate beyond this will not be feasible due to the following factors:

1. Costs of additional facilities (separation facilities and injection pumps) are estimated to be $500,000. Drilling two additional injection wells would cost as much as $8,000,000.

2. Deck space for any additional facilities is extremely limited and it is not known if deck loading would exceed design parameters.
3. Injection into two (Lower Repetto and Monterey) of the three potential injection zones is impractical. The present zone being waterflooded (Upper Repetto) cannot handle the larger volume of produced water without risking increased recycling of water and decreasing oil production and risking well control problems due to over pressuring the reservoir.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $1,056,675/ year. Trucking and disposal costs would be approximately $15,7600,700/ year.
2. Increase in air emissions may require offsets, which may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for docking and loading under stated scenario may be limited and/ or not available for required equipment.
4. Volume of trucks needed not available in the local area.

Pipelining produced water is infeasible due to the following factors:

1. Trucking and disposal costs would be approximately $15,800,000/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for additional storage tanks at onshore facility is not available and the onshore facility is not equipped to handle continuous truck traffic.
4. Volume of trucks needed is not available in the local area.

II. Drilling Muds & Cuttings

Platform Gilda may drill up to 20 (twenty) wells over the next five years. Each well could potentially generate 1000 BBL of drilling muds and cuttings.

Discharge	[4]Historic Discharge (BBL)	[5]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[6]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	20,000	0	137,500

[4] Drilling discharges over the past 5 years.
[5] Expected over the next five years
[6] Includes muds, cuttings, & cement (see NPDES permit for breakdown).

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Injection	Drill well, [7]Optimization, Facilities	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment

A. Injection:

1. Economic
   a. Drill Well – Cost of injection well would have a capital cost of $2,000,000 per re-drill and $4,000,000 per new well.
   b. Optimization – To convert existing producer or injector to disposal well would cost $1,500,000 to $2,000,000.
   c. Facilities – Rental of slurification facility would be $7,000/ day. Duration of drilling varies; however, it can typically last from 45 to 90 days.
2. Environmental/ Regulatory
   a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
   b. Agency review and approval required prior to drilling disposal well.
3. Social
   a. No Impact.
4. Technical
   a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug the likely permeable formation suitable for waste disposal.
   b. Power Supply – Current load is 1000 kVA and additional available shore power is 3950 kVA.
   c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

[7] Converting existing injector or producer into disposal well

B. Barging:

1. Economic
    a. Purchase/Rent Barges – Facility would need a project-dedicated 1,000 BBL barge each time a well is drilled. Estimated cost for purchase of barge is $140,000 and rental is $1,500/ day. Estimated cost of tug is $6,000/day.
    b. Trucking – The volume of fluids would require 9 trips per well with an estimated cost of $6,480 (@$720 per trip).
    c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
    d. Disposal – Cost of disposal would be approximately $1,500 per truck (totals $13,500 per well drilled). This includes solidification and disposal.
2. Environmental
    a. Air – Increased air emissions from tug operations only would generate NOx 22 lbs/well, HC 0.50 lbs/well, PM 0.26 lbs/well, and CO 2 lbs/well. This includes the use of one tug making one round trip and the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.
    b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate additional waste wash-down water, from cleaning the barges and any containers used in transport. The waste water will have to be dispose of in a permitted facility.
    c. Mooring – A mooring permit may be required.
    d. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
    a. Health – Increased air emissions in non-attainment area.
    b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
    c. Visual – New barge located at platform during drilling activities. Tug and barge traveling through the Santa Barbara Channel during drilling activities.
    d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.

4. Technical
    a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge.
    b. Positioning of barge relative to platform would need to be stable.

C. Drilling Muds & Cuttings Conclusion:

Injection of muds & cuttings will not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available on Gilda.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.

Barging drilling muds & cuttings is infeasible due to the following factors:

1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:

1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995).
2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.

3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

Discharge Alternatives Study for Platform Gina

Location: Latitude – 34° 17' 1.9" N and Longitude – 119° 16' 34.6" W
Nearest County — Ventura
OCS #: P 0202

I. Produced Water

Platform Gina discharges about 2,380 BBL/day or 868,700 BBL/year. The platform is authorized to discharge 69,863 BBL/day or 25,500,000 BBL/year. The current discharge is about 3.4% of the maximum limit.

Discharge	Average [1]Historic Discharge (BBL/Day)	Average Expected Discharge (BBL/Day)	[2]Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	2,380	2,380	868,367	25,500,000	0	0

The following alternatives have been considered for the ongoing injection of produced water and injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Re–injection	Drill well, [3]Optimization, Facilities, Operations	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment
Pipeline	Trucking , Facilities, Disposal	Air, Waste	Health, Traffic, Visual& Noise, Political	Trucks, Equipment

A. Re–injection of Produced Water:

1. Economic
    a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
    b. Facilities – Cost of additional facilities is estimated at $500,000. Dedicated on-board separation facilities would be required.

[1] Average is cumulative annual discharge/ 365
[2] December 2005 to November 2006
[3] Reconfigure and/ or chemically treat existing injection well or convert existing producer

Additional deck space may need to be created to accommodate the new separation facilities and additional pumps. Increase in pump capacity would be needed.

   c. Operations – $/bbl charge will increase lease operating expense.

2. Environmental/ Regulatory
   a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities. If the increase of emissions is not considered *de minimus*, offsets would be required.
   b. Regulatory – Modification of the DPP for operations may be needed. MMS approval would be required for conversion and drilling.
3. Social
   a. No Change.
4. Technical
   a. Geologic – Gina produces from two separate reservoirs: the Miocene Hueneme and the Oligocene Sespe formations. Hueneme formation is very permeable (10x greater than the Sespe) and a previous waterflood, using sea water, was discontinued in 1994 due to severe cycling of water.
   b. Power Supply – Current load is 290 kVA and additional available power is 4600 kVA.
   c. Facilities – To conduct produced water disposal, additional water handling equipment, such as dedicated on-board separation facilities and additional pumps, would have to be installed. Platform deck space is limited and deck loading would have to be reviewed.

B. Barging:

Scenario includes a permanent storage barge at the facility plus a transportation barge and tug (transportation barge and tug cost shared by each facility based on proportion).

1. Economic
   a. Purchase/Rent Barges – Facility would need a permanent 10,000 BBL barge. Estimated cost for purchase of barge is $148,000 and rental is $1,500/ day. Estimated cost of transport barge (40,000 BBL) and tug is $6,000/day of which Platform Gina would be charged $397/ day if all other platforms were also barging water. Additionally fuel cost is $265/day.
   b. Trucking – The volume of fluids would require 21 trips per day with an estimated cost of $7,800/ day.

c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
d. Disposal – Cost of disposal would be $5.50 BBL at a total daily cost of $13,100/ day.

2. Environmental/ Regulatory
   a. Air – Increased air emissions from tug operations only would generate NOx 678 lbs/year, HC 17 lbs/year, PM 8 lbs/year, and CO 66 lbs/year. This includes the use of one tug making one round *well* each day. Additional increases would come from the permanent barge, transportation barge, and trucking.
   b. Waste – Sanitary waste and operational waste (tug).
   c. Mooring – Obtain mooring permit.
   d. Permit approval – Development and Production Plan may need to be modified.
   e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (7 round trips per week; 365 trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic (21 round trips per day).
   c. Visual – New barge located next to Platform Gilda (195' x 35 x 10'). Tug and barge traveling through the Santa Barbara Channel daily.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Space available for docking barge at Port Hueneme. Space for trucking may be limited. Increased traffic to Port Hueneme may be limited.
   b. Equipment limitations – Limited vacuum trucks.

C. Pipeline:

1. Economic
   a. Trucking – The volume of fluids would require 21 trips per day with an estimated cost of $7,800/ day.
   b. Facilities – Additional facility modifications would be required at the onshore facility. The major item would be an additional produced water storage tank for Gina. Cost for an additional tank would

probably exceed $100,000, but the cost is immaterial because there is no room for such a tank at the Mandalay Onshore Facility, where the pipeline comes ashore, and no way to expand the size of the facility. Additional costs of facility modifications for a loading facility would be required, if it were possible to store the additional water.

   c. Disposal – Cost of disposal would be $5.50 BBL at a total daily cost of $13,090/ day.

2. Environmental/ Regulatory
   a. Air – Increased air emissions from additional components, tanks, and trucking.
   b. Waste – Tank cleanings and chemical waste.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic – Increased vehicle traffic (21 round trips per day) on Port Hueneme and Oxnard city streets, Hwy 101, and Hwy 126.
   c. Visual & Noise – Increased traffic along Port Hueneme and Oxnard city streets, Hwy 101, and Hwy 126.
   d. Political – Oil and gas operations increasing traffic and emissions in the Ventura County area.
4. Technical
   a. Facilities – There is a 4000 BBL produced water storage tank at the Mandalay Onshore Facility; and it is used to process the produced water for two platforms (Gilda and Gina). As noted under economics, there is no space for extra storage tanks. Space is limited for trucks.
   b. Equipment limitations – Limited numbers of vacuum trucks available.

D. Produced Water Conclusion:

There is no injection of water at Platform Gina. Adding such a program will not be feasible due to the following factors:

1. Costs of additional facilities (separation facilities and injection pumps) are estimated to be $500,000. Minimum waterflood project costs using produced water would be $5,000,000. Drilling two additional injection wells would cost as much as $8,000,000. This platform has marginal economics without adding the expense of water injection.
2. Deck space for any additional facilities is extremely limited and it is not known if deck loading would exceed design parameters.
3. Injection into the very permeable Hueneme formation has been shown to be impractical due to severe cycling of water. Injection into the tighter

Sespe formation can be accomplished, but the costs involved could render the platform uneconomic.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $789,130/ year. Trucking and disposal costs would be approximately $7,639,450/ year.
2. Increase in air emissions may require offsets, which may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for docking and loading under stated scenario may be limited and/ or not available for required equipment.
4. Volume of trucks needed not available in the local area.

Pipelining produced water is infeasible due to the following factors:

1. Trucking and disposal costs would be approximately $7,639,450/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for additional storage tanks at onshore facility is not available and the onshore facility is not equipped to handle continuous truck traffic.
4. Volume of trucks needed is not available in the local area.

II. Drilling Muds & Cuttings

There are no plans to drill any wells at Platform Gina in the next five years. In case those plans change (not expected), an evaluation is presented for the hypothetical drilling of two (2) wells at Platform Gina.

Discharge	[4]Historic Discharge (BBL)	[5]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[6]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	2,000	0	137,500

[4] Drilling discharges over the past 5 years.
[5] No discharges are expected; this hypothetical example is for two wells in the next five years.
[6] Includes muds, cuttings, & cement (see NPDES permit for breakdown).

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	**Environmental/ Regulatory**	**Social**	**Technical**
Injection	Drill well, [7]Optimization, Facilities	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment

A. Injection:

1. Economic
    a. Drill Well – Cost of injection well would have a capital cost of $2,000,000 per re-drill and $4,000,000 per new well.
    b. Optimization – To convert existing producer or injector to disposal well would cost $1,500,000 to $2,000,000.
    c. Facilities – Rental of slurification facility would be $7,000/ day. Duration of drilling varies; however, it can typically last from 45 to 90 days.
2. Environmental/ Regulatory
    a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
    b. Agency review and approval required prior to drilling disposal well.
3. Social
    a. No Impact.
4. Technical
    a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug the likely permeable formation suitable for waste disposal.
    b. Power Supply – Current load is 290 kVA and additional available power is 4600 kVA.
    c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

B. Barging:

1. Economic
    a. Purchase/Rent Barges – Facility would need a project-dedicated 1,000 BBL barge each time a well is drilled. Estimated cost for

[7] Converting existing injector or producer into disposal well

purchase of barge is $150,000 and rental is $500/ day. Estimated cost of tug is $6,000/day.

   b. Trucking– The volume of fluids would require 9 trips per well with an estimated cost of $6,480 (@$720 per trip).
   c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
   d. Disposal – Cost of disposal would be approximately $1,500 per truck (totals $13,500 per well drilled). This includes solidification and disposal.

2. Environmental
   a. Air – increased air emissions from tug operations only would generate NOx 22 lbs/well, HC 0.50 lbs/well, PM 0.26 lbs/well, and CO 2 lbs/well. This includes the use of one tug making one round trip and the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.
   b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate additional waste wash-down water, from cleaning the barges and any containers used in transport. The waste water will have to be dispose of in a permitted facility.
   c. Mooring – A mooring permit may be required.
   d. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
   c. Visual – New barge located at platform during drilling activities. Tug and barge traveling through the Santa Barbara Channel during drilling activities.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge.
   b. Positioning of barge relative to platform would need to be stable.

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D. Drilling Muds & Cuttings Conclusion:

As noted above, there are no plans to drill any wells at Gina in the next 5 years. The hypothetical wells discussed here are presented in case these plans unexpectedly change.

Injection of muds & cuttings would not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available on Gina.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.

Barging drilling muds & cuttings is infeasible due to the following factors:

1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:

1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995)
2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.

3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

DCOR

Discharge Alternatives Study for Platform A

Location: Latitude–34° 19' 55.0" N and Longitude–119° 36' 45.0" W
Nearest County— Santa Barbara
OCS #: P 0241

I. Produced Water

Platform A discharges about 8,600 BBL/day or 3,139,000 BBL/ year and injects approximately 16,000 BBL/day or 5,840,000 BBL/year. The platform is authorized to discharge 36,000 BBL/ Day or 13,140,000 BBL/year. The current discharge is about 24% of the maximum limit. Future ("Expected") injection will be increased to 17,000 BBL/day and overboard discharge reduced by 1000 BBL/day.

Discharge	Average [1]Historic Discharge (BBL/Day)	Average Expected Discharge (BBL/Day)	[2]Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	8,600	7,600	3,139,000	13,140,000	16,000	17,000

The following alternatives have been considered for ongoing injection of produced water and injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Re-injection	Drill well, [3]Optimization, Facilities, Operations	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment
Pipeline	Trucking , Facilities, Disposal	Air, Waste	Health, Traffic, Visual& Noise, Political	Trucks, Equipment

[1] Average is cumulative annual discharge/ 365
[2] December 2005 to November 2006
[3] Reconfigure and/ or chemically treat existing injection well or convert existing producer

A. Re-injection of Produced Water:

1. Economic
   a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
   b. Optimization – Optimization of existing injection wells and conversion of producing wells to injection will range from $400,000– $800,000.
   c. Facilities – Cost of additional facilities is estimated at $10–$25,000,000. Tank capacity would be needed for fluctuations in water production. Additional deck space is needed for tank(s). Increase in pump capacity needed.
   d. Operations – $/bbl charge will increase lease operating expense.
2. Environmental/ Regulatory
   a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities. If the increase of emissions is not considered *de minimus*, offsets would be required.
   b. Regulatory – Injection pressures in the Dos Cuadras Field reservoir are limited by USGS regulatory stipulations to maintain the integrity of the reservoir. In the present configuration of the injection wells, injection of additional water volumes would exceed these limitations. MMS approval required for conversion and drilling.
3. Social
   a. No Change.
4. Technical
   a. Geologic – the platform currently has a peripheral water flood in place. The current injection scheme is experiencing breakthrough due to zones of high permeability sands ("thief zones") within the reservoir. Increasing water injection capacities will likely increase cycling of water between injector and producer wells.
   b. Power Supply – Current load is 1750 kVA and additional available shore power is 2000 kVA.
   c. Facilities – Control processes on the platform limit the amount of water that can be injected. Since the volume of water being produced varies in time, water levels within the Wemco oil/water separation system are maintained by the present, permitted discharge of excess water into the ocean. There is no available room on the platform for a surge tank large enough to manage the production fluctuations.

B. Barging:

Scenario includes a permanent storage barge at the facility plus a transportation barge and tug (transportation barge and tug cost shared by each facility based on proportion).

1. Economic
    a. Purchase/Rent Barges – Facility would need a permanent 25,000 BBL barge. Estimated cost for purchase of barge is $280,000 and rental is $2,000/ day. Estimated cost of barge (40,000 BBL) and tug is $6,000/day of which Platform A would be charged $1,440/ day. Additionally fuel cost is $965/day.
    b. Trucking – The volume of fluids would require 75 trips per day with an estimated cost of $28,000/ day.
    c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
    d. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $47,300/ day.
2. Environmental/ Regulatory
    a. Air – Increased air emissions from tug operations only would generate 678 lbs of NOx/year, 17 lbs of HC/year, 8 lbs of PM/year, and 66 lbs of CO/year. This includes the use of one tug making one round trip each day. Additional increases would come from the permanent barge, transportation barge, and trucking.
    b. Waste – Sanitary waste and operational waste (tug).
    c. Mooring – Obtain mooring permit.
    d. Permit approval – Modify development and production plan.
    e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (7 round trips per week; 365 round trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
    a. Health – Increased air emissions in non-attainment area
    b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic (75 round trips per day).
    c. Visual – New barge located next to Platform A (230′ x 60′ x 15.5′). Tug and barge traveling through the Santa Barbara Channel daily.
    d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
    a. Facilities – Space available for docking barge at Port Hueneme. Space for trucking may be limited. Increased traffic to Port Hueneme may be limited.
    b. Equipment limitations – Limited vacuum trucks.

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C. Pipeline:

1. Economic
   a. Trucking – The volume of fluids would require 75 trips per day with an estimated cost of $28,000/ day.
   b. Facilities – Additional facility modifications required at the onshore facility. Cost for additional tanks would be $250,000. Modifications required for loading facility.
   c. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $47,300/ day.
2. Environmental/ Regulatory
   a. Air – Increased air emissions from additional components, tanks, and trucking.
   b. Waste – Tank cleanings and chemical waste.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic – Increased vehicle traffic (75 round trips per day) on Hwy 101 and Hwy 126.
   c. Visual & Noise – Increased traffic along Hwy 101 and Hwy 126.
   d. Political – Oil and gas operations increasing traffic and emissions in the Ventura area.
4. Technical
   a. Facilities – Space limited for extra storage tanks. Space limited for trucks.
   b. Equipment limitations – Limited vacuum trucks.

D. Produced Water Conclusion:

The ongoing injection of water at the current rate seems feasible for the near future. Injection rates will be increased by another 1000 BBL per day. However, increasing the water injection rate beyond this will not be feasible due to the following factors:

1. Costs of additional facilities are in excess of $10,000,000 and may be as much as $25,000,000. Drilling two additional injection wells would cost as much as $8,000,000. Optimization of four injectors would cost as much as $3,200,000. Total capital cost could be in excess of $36,200,000.
2. Injection pressures are limited by USGS stipulations.
3. Space needed for additional surge tank is not available.
4. Thief zones may make additional injection not effective in increasing injection capacity.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $1,606,730/ year. Trucking and disposal costs would be approximately $27,500,000/ year.

2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for docking and loading under stated scenario may be limited and/ or not available for required equipment.
4. Volume of trucks needed not available in the local area.

Pipelining produced water is infeasible due to the following factors:

1. Trucking and disposal costs would be approximately $27,500,000/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for loading at onshore facility is limited and cannot handle traffic volume.
4. Volume of trucks needed not available in the local area.

II. Drilling Muds & Cuttings

Platform A could drill up to 5 five wells over the next five years. Each well could potentially generate 600 BBL of drilling muds and cuttings.

Discharge	Historic Discharge (BBL)	[4]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[5]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	3,000	0	135,000

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Injection	Drill well, [6]Optimization, Facilities	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment

[4] Expected over the next five years
[5] Includes muds, cuttings, & cement (see NPDES permit for breakdown).
[6] Converting existing injector or producer into disposal well

DCOR

A. Injection:

1. Economic
   a. Drill Well – Cost of injection well would have a capital cost of \$2,000,000 per re–drill and \$4,000,000 per new well.
   b. Optimization – To convert existing producer or injector to disposal well would cost \$1,500,000 to \$2,000,000.
   c. Facilities – Rental of slurification facility would be \$7,000/ day. Duration of drilling varies; however, it can typically last from 45 to 90 days.
2. Environmental/ Regulatory
   a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
   b. Agency review and approval required prior to drilling disposal well.
3. Social
   a. No Impact.
4. Technical
   a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug any permeable formation suitable for waste disposal.
   b. Power Supply – Current load is 1750 kVA and additional available shore power is 2000 kVA.
   c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

B. Barging:

1. Economic
   a. Purchase/Rent Barges – Facility would need a project dedicated 1,000 BBL barge. Estimated cost for purchase of barge is \$150,000 and rental is \$500/ day. Estimated cost of tug is \$6,000/day.
   b. Trucking – The volume of fluids would require 5 trips per well with an estimated cost of \$3,600.
   c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
   d. Disposal – Cost of disposal would be \$1,500 per truck. This includes solidification and disposal.
2. Environmental
   a. Air – Increased air emissions from tug operations only would generate 22 lbs of NO_x/well, 0.50 lbs of HC/well, 0.26 lbs of PM/well, and 2 lbs of CO/well. This includes the use of one tug

making one round trip at the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.

   b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate one additional waste, wash down water, from cleaning the barges and any containers used in transport. The waste water will have to be disposed of in a permitted facility.
   c. Mooring – A mooring permit may be required.
   d. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.

3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
   c. Visual – New barge located at platform during drilling activities. Tug and barge traveling through the Santa Barbara Channel during drilling activities.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge.
   b. Positioning of barge relative to platform would need to be stable.

C. Drilling Muds & Cuttings Conclusion:

Injection of muds & cuttings will not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.

5. Introducing an additional injection well will reduce power availability for operational flexibility.

Barging drilling muds & cuttings is infeasible due to the following factors:

1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:

1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995).
2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.
3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

Discharge Alternatives Study for Platform B

Location: Latitude–34° 19' 57.0" N and Longitude– 119° 37' 18.0" W
Nearest County— Santa Barbara
OCS #: P 0241

I. Produced Water

Platform B discharges about 7,260 BBL/day or 2,649,900 BBL/year and injects approximately 15,000 BBL/day or 5,475,000 BBL/year. The platform is authorized to discharge 45,000BBL/day or 16,425,000BBL/year. The current discharge is about 16% of the maximum limit.

Discharge	Average [1]Historic Discharge (BBL/Day)	Average Expected Discharge (BBL/Day)	[2]Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	7,260	6,260	2,649,900	16,425,000	15,000	16,000

The following alternatives have been considered for ongoing injection of produced water and injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Re–injection	Drill well, [3]Optimization, Facilities, Operations	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment
Pipeline	Trucking , Facilities, Disposal	Air, Waste	Health, Traffic, Visual& Noise, Political	Trucks, Equipment

A. Re–injection of Produced Water:

1. Economic
   a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.

[1] Average is cumulative annual discharge/ 365
[2] December 2005 to November 2006
[3] Reconfigure and/ or chemically treat existing injection well or convert existing producer

DCOR

   b. Optimization – Optimization of existing injection wells and conversion of producing wells to injection will range from $400,000– $800,000.
   c. Facilities – Cost of additional facilities is estimated at $10–$25,000.000. Tank capacity would be needed for fluctuations in water production. Additional deck space is needed for tank(s). Increase in pump capacity needed.
   d. Operations – $/bbl charge will increase lease operating expense.
2. Environmental/ Regulatory
   a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities. If the increase of emissions is not considered de minimus, offsets would be required.
   b. Regulatory – Injection pressures in the Dos Cuadras Field reservoir are limited by USGS regulatory stipulations to maintain the integrity of the reservoir. In the present configuration of the injection wells, injection of additional water volumes would exceed these limitations. MMS approval required for conversion and drilling.
3. Social
   a. No Change.
4. Technical
   a. Geologic – The platform currently has a peripheral water flood in place. The current injection scheme is experiencing breakthrough due to zones of high permeability sands ("thief zones") within the reservoir. Increasing water injection capacities will likely increase cycling of water between injector and producer wells.
   b. Power Supply – Current load is 1875 kVA; additional available shore power is 1875 kVA.
   c. Facilities – Control processes on the platform limit the amount of water that can be injected. Since the volume of water being produce varies in time, water levels within the Wemco oil/water separation system are maintained by the present, permitted discharge of excess water into the ocean. There is no available room on the platform for a surge tank large enough to manage the production fluctuations.

B. Barging:

Scenario includes a permanent storage barge at the facility plus a transportation barge and tug (transportation barge and tug cost shared by each facility based on proportion).

1. Economic
   a. Purchase/Rent Barges – Facility would need a permanent 25,000 BBL barge. Estimated cost for purchase of barge is $280,000 and

rental is $2,000/ day. Estimated cost of transport barge (40,000 BBL) and tug is $6,000/day of which Platform B would be charged $1,220/ day. Additionally fuel cost is $800/day.

   b. Trucking – The volume of fluids would require 60 trips per day with an estimated cost of $22,400/ day.
   c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
   d. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $39,930/ day.

2. Environmental/ Regulatory
   a. Air – Increased air emissions from tug operations only would generate 678 lbs of NOx/year, 17 lbs of HC/year, 8 lbs of PM/year, and 6 6lbs of CO/year. This includes the use of one tug making one round trip each day. Additional increases would come from the permanent barge, transportation barge, and trucking.
   b. Waste – Sanitary waste and operational waste (tug).
   c. Mooring – Obtain mooring permit.
   d. Permit approval – Modify development and production plan.
   e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (7 round trips per week; 365 round trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic (60 round trips per day).
   c. Visual – New barge located next to Platform B (230' x 60' x 15.5'). Tug and barge traveling through the Santa Barbara Channel daily.
   d. Political – oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Space available for docking barge at Port Hueneme. Space for trucking may be limited. Increased traffic to Port Hueneme may be limited.
   b. Equipment limitations – Limited vacuum trucks.

C. Pipeline:

1. Economic
    a. Trucking – The volume of fluids would require 60 trips per day with an estimated cost of $22,400/day.
    b. Facilities – Additional facility modifications required at the onshore facility. Cost for additional tanks would be $250,000. Modifications required for loading facility.
    c. Disposal – Cost of disposal would be $5.50/BBL at a total daily cost of $39,930/ day.
2. Environmental/ Regulatory
    a. Air – Increased air emissions from additional components, tanks, and trucking.
    b. Waste – Tank cleanings and chemical waste.
3. Social
    a. Health – Increased air emissions in non-attainment area.
    b. Traffic – Increased vehicle traffic (60 round trips per day) on Hwy 101 and Hwy 126.
    c. Visual & Noise – Increased traffic along Hwy 101 and Hwy 126.
    d. Political – Oil and gas operations increasing traffic and emissions in the Ventura area.
4. Technical
    a. Facilities – Space limited for extra storage tanks. Space limited for trucks.
    b. Equipment limitations – Limited vacuum trucks.

D. Produced Water Conclusion:

The ongoing injection of water at the current rate seems feasible for the near future. Injection rates will be increased by another 1000 BBL day. However, increasing the water injection rate beyond this will not be feasible due to the following factors:

1. Costs of additional facilities are in excess of $10,000,000 and may be as much as $25,000,000. Drilling two additional injection wells would cost as much as $8,000,000. Optimization of four injectors would cost as much as $3,200,000. Total capital cost could be in excess of $36,200,000.
2. Injection pressures are limited by USGS stipulations.
3. Space needed for additional surge tank is not available.
4. Thief zones may make additional injection not effective in increasing injection capacity.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $1,465,110/year. Trucking and disposal costs would be approximately $22,750,000/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for docking and loading under stated scenario may be limited and/ or not available for required equipment.
4. Volume of trucks needed not available in the local area.

Pipelining produced water is infeasible due to the following factors:

1. Trucking and disposal costs would be approximately $22,750,000/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for loading at onshore facility is limited and cannot handle traffic volume.
4. Volume of trucks needed not available in the local area.

II. Drilling Muds & Cuttings

Platform B could drill up to 5 five wells over the next five years. Each well could potentially generate 600 BBL of drilling muds and cuttings.

Discharge	Historic Discharge (BBL)	[4]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[5]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	3,000	0	138,000

[4] Expected over the next five years
[5] Includes muds, cuttings, & cement (see NPDES permit for breakdown).

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Injection	Drill well, [6]Optimization, Facilities	Air, Regulatory	No impact	Geologic, Power Supply, Facilities

A. Injection:

1. Economic
    a. Drill Well – Cost of injection well would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
    b. Optimization – To convert existing producer or injector to disposal well would cost $1,500,000 to $2,000,000.
    c. Facilities – Rental of slurification facility would be $7,000/ day. Duration of drilling varies; however, it can typically last from 45 to 90 days.
2. Environmental/ Regulatory
    a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
    b. Agency review and approval required prior to drilling disposal well.
3. Social
    a. No Impact.
4. Technical
    a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug any permeable formation suitable for waste disposal.
    b. Power Supply – Current load is 1875 kVA; additional available shore power is 1875 kVA.
    c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

B. Barging:

1. Economic.
    a. Purchase/Rent Barges – Facility would need a project dedicated 1,000 BBL barge. Estimated cost for purchase of barge is $150,000 and rent0al is $500/ day. Estimated cost of tug is $6,000/day.

[6] Converting existing injector or producer into disposal well

b. Trucking – The volume of fluids would require 5 trips per well with an estimated cost of $3,600.
c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
d. Disposal – Cost of disposal would be $1,500 per truck. This includes solidification and disposal.

2. Environmental
   a. Air – Increased air emissions from tug operations only would generate 22 lbs of NOx/well, 0.50lbs of HC/well, 0.26 lbs of PM/well and 2lbs of CO/well. This includes the use of one tug, making one round trip at the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.
   b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate one additional waste, wash down water from cleaning the barges and any containers used in transport. The waste water will have to be disposed of in a permitted facility.
   c. Mooring – A mooring permit may be required.
   d. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
   c. Visual – New barge located at platform during drilling activities. Tug and barge traveling through the Santa Barbara Channel during drilling activities.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge.
   b. Positioning of barge relative to platform would need to be stable.

C. Drilling Muds & Cuttings Conclusion:

Injection of muds & cuttings will not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.
5. Introducing an additional injection well will reduce power availability for operational flexibility.

Barging drilling muds & cuttings is infeasible due to the following factors:

1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:

1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995).
2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.
3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly

plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

DCOR

Discharge Alternatives Study for Platform C

Location: Latitude–34° 19' 58.5" N and Longitude– 119° 37' 50.8" W
Nearest County— Santa Barbara
OCS #: P 0241

I. Produced Water

Platform "C" does not discharge any of its produced water overboard; instead it sends it to Platform"B" for overboard discharge. However, it has a permit to discharge 13,140,000 BBL/year. Since it is possible that the present discharge scheme could change in the future, for the purposes of this analysis, alternatives to a hypothetical produced water discharge of 2000 BBL are evaluated.

Discharges	Historic Discharge BBL/Day (Ave)	[1]Expected Discharge BBL/Day (Ave)	Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	0	2,000	0	13,140,000	7,500	8,000

The following alternatives have been considered for ongoing injection of produced water and injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Re–injection	Drill well, [2]Optimization, Facilities, Operations	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment
Pipeline	Trucking , Facilities, Disposal	Air, Waste	Health, Traffic, Visual& Noise, Political	Trucks, Equipment

A. Re-injection of Produced Water:

1. Economic
   a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.

[1] No discharge is expected at this time; this is a hypothetical example.
[2] Reconfigure and/ or chemically treat existing injection well or convert existing producer

b. Optimization – Optimization of existing injection wells and conversion of producing wells to injection will range from $400,000– $800,000.
c. Facilities – Cost of additional facilities is estimated at $10–$25,000.000. Tank capacity would be needed for fluctuations in water production. Additional deck space is needed for tank(s). Increase in pump capacity needed.
d. Operations – $/bbl charge will increase lease operating expense.

2. Environmental/ Regulatory
   a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities. If the increase of emissions is not considered de minimus, offsets would be required.
   b. Regulatory – Injection pressures in the Dos Cuadras Field reservoir are limited by USGS regulatory stipulations to maintain the integrity of the reservoir. In the present configuration of the injection wells, injection of additional water volumes would exceed these limitations. MMS approval required for conversion and drilling.
3. Social
   a. No Change.
4. Technical
   a. Geologic – The platform currently has a peripheral water flood in place. The current injection scheme is experiencing breakthrough due to zones of high permeability sands ("thief zones") within the reservoir. Increasing water injection capacities will likely increase cycling of water between injector and producer wells.
   b. Power Supply – Current load is 600 KVA; additional available shore power is 3150 KVA.
   c. Facilities – Control processes on the platform limit the amount of water that can be injected. Since the volume of water being produce varies in time, water levels within the Wemco oil/water separation system are maintained by the present, permitted discharge of excess water into the ocean. There is no available room on the platform for a surge tank large enough to manage the production fluctuations.

B. Barging:

Scenario includes a permanent storage barge at the facility plus a transportation barge and tug (transportation barge and tug cost shared by each facility based on proportion).

1. Economic
   a. Purchase/Rent Barges – Facility would need a permanent 10,000 BBL barge. Estimated cost for purchase of barge is $140,000 and

rental is $1,500/ day. Estimated cost of barge (40,000 BBL) and tug is $6,000/day of which Platform C would be charged $335 day. Additionally fuel cost is $220/day.

   b. Trucking – The volume of fluids would require 18 trips per day with an estimated cost of $6,720/ day.
   c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
   d. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $11,000/ day.

2. Environmental/ Regulatory
   a. Air – Increased air emissions from tug operations only would generate 678 lbs of NOx/year, 17 lbs of HC/year, 8 lbs of PM/year, and 66 lbs of CO/year. This includes the use of one tug making one round trip each day. Additional increases would come from the permanent barge, transportation barge, and trucking.
   b. Waste – Sanitary waste and operational waste (tug).
   c. Mooring – Obtain mooring permit.
   d. Permit approval – Modify development and production plan
   e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (7 round trips per week; 365 round trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic (Several round trips per day).
   c. Visual – New barge located next to Platform C, Tug and barge traveling through the Santa Barbara Channel daily.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Space available for docking barge at Port Hueneme. Space for trucking may be limited. Increased traffic to Port Hueneme may be limited.
   b. Equipment limitations – Limited vacuum trucks.

B. Pipeline:

1. Economic
    a. Trucking – The volume of fluids would require several trips per day with an estimated cost of $6,720/ day.
    b. Facilities – Additional facility modifications required at the onshore facility. Cost for additional tanks would be $250,000. Modifications required for loading facility.
    c. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $11,000/ day.
2. Environmental/ Regulatory
    a. Air – Increased air emissions from additional components, tanks, and trucking.
    b. Waste – Tank cleanings and chemical waste.
3. Social
    a. Health – Increased air emissions in non-attainment area.
    b. Traffic – Increased vehicle traffic (Several round trips per day) on Hwy 101 and Hwy 126.
    c. Visual & Noise – Increased traffic along Hwy 101 and Hwy 126.
    d. Political – Oil and gas operations increasing traffic and emissions in the Ventura area.
4. Technical
    a. Facilities – Space limited for extra storage tanks. Space limited for trucks.
    b. Equipment limitations – Limited vacuum trucks.

C. Produced Water Conclusion:

The ongoing injection of water at the current rate seems feasible for the near future. Injection rates will be increased by another 500 BBL per day. However, increasing the water injection rate beyond this will not be feasible due to the following factors:

1. Costs of additional facilities are in excess of $10,000,000 and may be as much as $25,000,000. Drilling two additional injection wells would cost as much as $8,000,000. Optimization of four injectors would cost as much as $3,200,000. Total capital cost could be in excess of $36,200,000.
2. Injection pressures are limited by USGS stipulations.
3. Space needed for additional surge tank is not available.
4. Thief zones may make additional injection not effective in increasing injection capacity.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $750,075/ year. Trucking and disposal costs would be approximately $6,467,800/ year.

2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for docking and loading under stated scenario may be limited and/or not available for required equipment.
4. Volume of trucks needed not available in the local area.

Pipelining produced water is infeasible due to the following factors:

1. Trucking and disposal costs would be approximately $6,467,000/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for loading at onshore facility is limited and cannot handle traffic volume.
4. Volume of trucks needed not available in the local area.

II. Drilling Muds & Cuttings

Platform C could drill up to 5 five wells over the next five years. Each well could potentially generate 600 BBL of drilling muds and cuttings.

Discharge	Historic Discharge (BBL)	[3]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[4]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	3,000	0	135,000

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Injection	Drill well, [5]Optimization, Facilities	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment

[3] Expected over the next five years
[4] Includes muds, cuttings, & cement (see NPDES permit for breakdown).
[5] Converting existing injector or producer into disposal well

A. Injection:

1. Economic
   a. Drill Well – Cost of injection well would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
   b. Optimization – To convert existing producer or injector to disposal well would cost $1,500,000 to $2,000,000.
   c. Facilities – Rental of slurification facility would be $7,000/ day. Duration of drilling varies; however, it can typically last from 45 to 90 days.
2. Environmental/ Regulatory
   a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
   b. Agency review and approval required prior to drilling disposal well.
3. Social
   a. No Impact.
4. Technical
   a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug any permeable formation suitable for waste disposal.
   b. Power Supply – Current load is 600 kVA; additional available shore power is 3150 kVA.
   c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

B. Barging:

1. Economic
   a. Purchase/Rent Barges – Facility would need a project dedicated 1,000 BBL barge. Estimated cost for purchase of barge is $150,000 and rental is $500/ day. Estimated cost of tug is $6,000/day.
   b. Trucking – The volume of fluids would require 5 trips per well with an estimated cost of $3,600.
   c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
   d. Disposal – Cost of disposal would be $1,500 per truck. This includes solidification and disposal.
2. Environmental
   a. Air – Increased air emissions from tug operations only would generate 22 lbs of NOx/well, 0.50 lbs of HC/well, 0.26 lbs of PM/well, and 2 lbs of CO/well. This includes the use of one tug

making one round trip at the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.

   b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate one additional waste, wash down water, from cleaning the barges and any containers used in transport. The waste water will have to be disposed of in a permitted facility.
   c. Mooring – A mooring permit may be required.
   d. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
   c. Visual – new barge located at platform during drilling activities. Tug and barge traveling through the Santa Barbara Channel during drilling activities.
   d. Political – oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge.
   b. Positioning of barge relative to platform would need to be stable.

C. Drilling Muds & Cuttings Conclusion:

Injection of muds & cuttings will not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.

5. Introducing an additional injection well will reduce power availability for operational flexibility.

Barging drilling muds & cuttings is infeasible due to the following factors:
1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:
1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995).
2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.
3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

Discharge Alternatives Study for Platform Hillhouse

Location: Latitude– 34° 19' 53.0" N and Longitude– 119° 36' 12.0" W
Nearest County— Santa Barbara
OCS #: P 0240

I. Produced Water

Platform Hillhouse discharges about 7,876 BBL/day or 2,874,740 BBL/year. The platform is authorized to discharge 20,000BBL/day or 7,300,000 BBL/year. The current discharge is about 40% of the maximum limit.

Discharges	[1]Historic Discharge BBL/Day (Ave)	Expected Discharge BBL/Day (Ave)	Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	7,876	7,000	2,874,740	7,300,000	0	0

The following alternatives have been considered for ongoing injection of produced water and injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Re–injection	Drill well, [2]Optimization, Facilities, Operations	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment
Pipeline	Trucking , Facilities, Disposal	Air, Waste	Health, Traffic, Visual& Noise, Political	Trucks, Equipment

A. Re-injection of Produced Water:

1. Economic
   a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
   b. Optimization – Optimization of existing injection wells and conversion of producing wells to injection will range from $400,000– $800,000.
   c. Facilities – Cost of additional facilities is estimated at $10–$25,000,000. Tank capacity would be needed for fluctuations in

[1] Average is cumulative annual discharge/ 365
[2] Reconfigure and/ or chemically treat existing injection well or convert existing producer

water production. Additional deck space is needed for tank(s). Increase in pump capacity needed.
   d. Operations – $/bbl charge will increase lease operating expense.
2. Environmental/ Regulatory
   a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities. If the increase of emissions is not considered *de minimus* offsets would be required.
   b. Regulatory – Injection pressures in the Dos Cuadras Field reservoir are limited by USGS regulatory stipulations to maintain the integrity of the reservoir. In the present configuration of the injection wells, injection of additional water volumes would exceed these limitations. MMS approval required for conversion and drilling.
3. Social
   b. No Change.
4. Technical
   a. Geologic – The platform currently has a peripheral water flood in place. The current injection scheme is experiencing breakthrough due to zones of high permeability sands ("thief zones") within the reservoir. Increasing water injection capacities will likely increase cycling of water between injector and producer wells.
   b. Power Supply – Current load is 2162 kVA; additional available shore power is 1588 kVA.
   c. Facilities – Control processes on the platform limit the amount of water that can be injected. Since the volume of water being produce varies in time, water levels within the Wemco oil/water separation system are maintained by the present, permitted discharge of excess water into the ocean. There is no available room on the platform for a surge tank large enough to manage the production fluctuations.

B. Barging:

Scenario includes a permanent storage barge at the facility plus a transportation barge and tug (transportation barge and tug cost shared by each facility based on proportion).

1. Economic
   a. Purchase/Rent Barges – Facility would need a permanent 25,000 BBL barge. Estimated cost for purchase of barge is $280,000 and rental is $2,000/ day. Estimated cost of transport barge (40,000 BBL) and tug is $6,000/day of which Platform Hillhouse would be charged $1,315/ day. Additionally fuel cost is $875/day.
   b. Trucking – The volume of fluids would require 66 trips per day with an estimated cost of $24,640/ day.

c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
d. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $43,318.

2. Environmental/ Regulatory
   a. Air – Increased air emissions from tug operations only would generate 678 lbs of NOx/year, 17 lbs of HC/year, 8 lbs of PM/year, and 66 lbs of CO/year. This includes the use of one tug making one round trip each day. Additional increases would come from the permanent barge, transportation barge, and trucking.
   b. Waste – Sanitary waste and operational waste (tug).
   c. Mooring – Obtain mooring permit.
   d. Permit approval – Modify development and production plan.
   e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (7 round trips per week; 365 round trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic (66 round trips per day).
   c. Visual – New barge located next to Platform Hillhouse (230′ x 60′ x 15.5′). Tug and barge traveling through the Santa Barbara Channel daily.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Space available for docking barge at Port Hueneme. Space for trucking may be limited. Increased traffic to Port Hueneme may be limited.
   b. Equipment limitations – Limited vacuum trucks.

C. Pipeline:

1. Economic
   a. Trucking – The volume of fluids would require 66 trips per day with an estimated cost of $24,640/ day.
   b. Facilities – Additional facility modifications required at the onshore facility. Cost for additional tanks would be $250,000. Modifications required for loading facility.

c. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $43,318.

2. Environmental/ Regulatory
   a. Air – Increased air emissions from additional components, tanks, and trucking.
   b. Waste– Tank cleanings and chemical waste.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic – Increased vehicle traffic (66 round trips per day) on Hwy 101 and Hwy 126.
   c. Visual & Noise – Increased traffic along Hwy 101 and Hwy 126.
   d. Political – Oil and gas operations increasing traffic and emissions in the Ventura area.
4. Technical
   a. Facilities – Space limited for extra storage tanks. Space limited for trucks.
   b. Equipment limitations – Limited vacuum trucks.

D. Produced Water Conclusion:

The injection of Produced Water at Hillhouse is not feasible due the following factors:

1. Costs of additional facilities are in excess of $10,000,000 and may be as much as $25,000,000. Drilling two additional injection wells would cost as much as $8,000,000. Optimization of four injectors would cost as much as $3,200,000. Total capital cost could be in excess of $36,200,000.
2. Injection pressures are limited by USGS stipulations.
3. Space needed for additional surge tank is not available.
4. Thief zones may make additional injection not effective in increasing injection capacity.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $1,529,350/ year. Trucking and disposal costs would be approximately $24,800,000/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for docking and loading under stated scenario may be limited and/ or not available for required equipment.
4. Volume of trucks needed not available in the local area.

Pipelining produced water is infeasible due to the following factors:

1. Trucking and disposal costs would be approximately $24,800,000/ year.

2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for loading at onshore facility is limited and cannot handle traffic volume.
4. Volume of trucks needed not available in the local area.

II. Drilling Muds & Cuttings

Platform Hillhouse could drill up to 5 (five) wells over the next five years. Each well could potentially generate 600 BBL of drilling muds and cuttings.

Discharge	Historic Discharge (BBL)	[3]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[4]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	3,000	0	135,000

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Injection	Drill well, [5]Optimization, Facilities	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment

A. Injection:

1. Economic
   a. Drill Well – Cost of injection well would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
   b. Optimization – To convert existing producer or injector to disposal well would cost $1,500,000 to $2,000,000.
   c. Facilities – Rental of slurification facility would be $7,000/day. Duration of drilling varies; however, it can typically last from 45 to 90 days.

[3] Expected over the next five years
[4] Includes muds, cuttings, & cement (see NPDES permit for breakdown).
[5] Converting existing injector or producer into disposal well

2. Environmental/ Regulatory
    a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
    b. Agency review and approval required prior to drilling disposal well.
3. Social
    a. No Impact.
4. Technical
    a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug any permeable formation suitable for waste disposal.
    b. Power Supply – Current load is 2162 kVA; additional available shore power is 1588 kVA.
    c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

B. Barging:

1. Economic
    a. Purchase/Rent Barges – Facility would need a project dedicated 1,000 BBL barge. Estimated cost for purchase of barge is $150,000 and rental is $500/ day. Estimated cost of tug is $6,000/day.
    b. Trucking – The volume of fluids would require 5 trips per well with an estimated cost of $3,600.
    c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
    d. Disposal – Cost of disposal would be $1,500 per truck. This includes solidification and disposal.
2. Environmental
    a. Air – Increased air emissions from tug operations only would generate 22 lbs of NOx/well, 0.50 lbs of HC/well, 0.26 lbs of PM/well, and 2 lbs of CO/well. This includes the use of one tug making one round trip and the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.
    b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate additional waste, wash down water,

from cleaning the barges and any containers used in transport. The waste water will have to be disposed of in a permitted facility.

   c. Mooring – A mooring permit may be required.
   d. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.

3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
   c. Visual – New barge located at platform during drilling activities. Tug and barge traveling through the Santa Barbara Channel during drilling activities.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge.
   b. Positioning of barge relative to platform would need to be stable.

C. Drilling Muds & Cuttings Conclusion:

Injection of muds & cuttings will not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.
5. Introducing an additional injection well will reduce power availability for operational flexibility.

Barging drilling muds & cuttings is infeasible due to the following factors:

1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:

1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995).
2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.
3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

Discharge Alternatives Study for Platform Henry

Location: Latitude–34° 20' 9.5"N and Longitude–119° 33' 37.8"W.
Nearest County— Santa Barbara
OCS #: P 0240

I. Produced Water

Platform Henry does not discharge any of its produced water overboard; instead it sends it to Platform Hillhouse for overboard discharge. However, it has a permit to discharge 6,570,000 BBL/year.

Discharges	Historic Discharge BBL/Day (Ave)	[1]Expected Discharge BBL/Day (Ave)	Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	0	1800	**0**	**6,570,000**	100	150

The following alternatives have been considered for ongoing injection of produced water and injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	**Environmental/ Regulatory**	**Social**	**Technical**
Re–injection	Drill well, [2]Optimization, Facilities, Operations	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment
Pipeline	Trucking , Facilities, Disposal	Air, Waste	Health, Traffic, Visual& Noise, Political	Trucks, Equipment

A. Re-injection of Produced Water:

1. Economic
   a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.

[1] No discharge is expected at this time; this is a hypothetical example.
[2] Reconfigure and/ or chemically treat existing injection well or convert existing producer

DCOR

b. Optimization – Optimization of existing injection wells and conversion of producing wells to injection will range from $400,000–$800,000.
c. Facilities – Cost of additional facilities is estimated at $10–$25,000.000. Tank capacity would be needed for fluctuations in water production. Additional deck space is needed for tank(s). Increase in pump capacity needed.
d. Operations – $/bbl charge will increase lease operating expense.

2. Environmental/ Regulatory
   a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities. If the increase of emissions is not considered de minimus, offsets would be required.
   b. Regulatory – Injection pressures in the Dos Cuadras Field reservoir are limited by USGS regulatory stipulations to maintain the integrity of the reservoir. In the present configuration of the injection wells, injection of additional water volumes would exceed these limitations. MMS approval required for conversion and drilling.
3. Social
   a. No Change.
4. Technical
   a. Geologic – The platform currently has a peripheral water flood in place. The current injection scheme is experiencing breakthrough due to zones of high permeability sands ("thief zones") within the reservoir. Increasing water injection capacities will likely increase cycling of water between injector and producer wells.
   b. Power Supply – Current load is 515 KVA; additional available shore power is 2980 KVA.
   c. Facilities – Control processes on the platform limit the amount of water that can be injected. Since the volume of water being produce varies in time, water levels within the Wemco oil/water separation system are maintained by the present, permitted discharge of excess water into the ocean. There is no available room on the platform for a surge tank large enough to manage the production fluctuations.

B. Barging:

Scenario includes a permanent storage barge at the facility plus a transportation barge and tug (transportation barge and tug cost shared by each facility based on proportion).

1. Economic
   a. Purchase/Rent Barges – Facility would need a permanent 10,000 BBL barge. Estimated cost for purchase of barge is $140,000 and

rental is $1,500/ day. Estimated cost of barge (40,000 BBL) and tug is $6,000/day of which Platform Henry would be charged $300 day. Additionally fuel cost is $200/day.

   b. Trucking – The volume of fluids would require 15 trips per day with an estimated cost of $5,600/ day.
   c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
   d. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $9,900/ day.

2. Environmental/ Regulatory
   a. Air – Increased air emissions from tug operations only would generate 678 lbs of NOx/year, 17 lbs of HC/year, 8 lbs of PM/year, and 66 lbs of CO/year. This includes the use of one tug making one round trip each day. Additional increases would come from the permanent barge, transportation barge, and trucking.
   b. Waste – Sanitary waste and operational waste (tug).
   c. Mooring – Obtain mooring permit.
   d. Permit approval – Modify development and production plan.
   e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (7 round trips per week; 365 round trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic (Several round trips per day).
   c. Visual – New barge located next to Platform Henry; tug and barge traveling through the Santa Barbara Channel daily.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Space available for docking barge at Port Hueneme. Space for trucking may be limited. Increased traffic to Port Hueneme may be limited.
   b. Equipment limitations – Limited vacuum trucks.

C. Pipeline:

1. Economic
    a. Trucking – The volume of fluids would require 15 trips per day with an estimated cost of $5,600/ day.
    b. Facilities – Additional facility modifications required at the onshore facility. Cost for additional tanks would be $250,000. Modifications required for loading facility.
    c. Disposal – Cost of disposal would be $5.50/ BBL at a total daily cost of $9,900/ day.
2. Environmental/ Regulatory
    a. Air – Increased air emissions from additional components, tanks, and trucking.
    b. Waste – Tank cleanings and chemical waste.
3. Social
    a. Health – Increased air emissions in non-attainment area.
    b. Traffic – Increased vehicle traffic (Several round trips per day) on Hwy 101 and Hwy 126.
    c. Visual & Noise – Increased traffic along Hwy 101 and Hwy 126.
    d. Political – Oil and gas operations increasing traffic and emissions in the Ventura area.
4. Technical
    a. Facilities – Space limited for extra storage tanks. Space limited for trucks.
    b. Equipment limitations – limited vacuum trucks.

D. Produced Water Conclusion:

The ongoing injection of water at the current rate seems feasible for the near future. Injection rates will be increased by another 500 BBL per day. However, increasing the water injection rate beyond this will not be feasible due to the following factors:

1. Costs of additional facilities are in excess of $10,000,000 and may be as much as $25,000,000. Drilling two additional injection wells would cost as much as $8,000,000. Optimization of four injectors would cost as much as $3,200,000. Total capital cost could be in excess of $36,200,000.
2. Injection pressures are limited by USGS stipulations.
3. Space needed for additional surge tank is not available.
4. Thief zones may make additional injection not effective in increasing injection capacity.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $730,000/ year. Trucking and disposal costs would be approximately $5,657,500/ year.

2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for docking and loading under stated scenario may be limited and/ or not available for required equipment.
4. Volume of trucks needed not available in the local area.

Pipelining produced water is infeasible due to the following factors:
1. Trucking and disposal costs would be approximately $5,657,500/ year.
2. Increase in air emissions would require offsets. These may not be available. Increase in trucking emissions have not been calculated, however, they would be substantial and must not be discounted.
3. Space for loading at onshore facility is limited and cannot handle traffic volume.
4. Volume of trucks needed not available in the local area.

II. Drilling Muds & Cuttings

Platform Henry could drill up to 5 five wells over the next five years. Each well could potentially generate 600 BBL of drilling muds and cuttings.

Discharge	Historic Discharge (BBL)	[3]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[4]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	3,000	0	135,000

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Injection	Drill well, [5]Optimization, Facilities	Air, Regulatory	No impact	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities, Equipment

[3] Expected over the next five years
[4] Includes muds, cuttings, & cement (see NPDES permit for breakdown).
[5] Converting existing injector or producer into disposal well

A. Injection:

1. Economic
    a. Drill Well – Cost of injection well would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
    b. Optimization – To convert existing producer or injector to disposal well would cost $1,500,000 to $2,000,000.
    c. Facilities – Rental of slurification facility would be $7,000/ day. Duration of drilling varies; however, it can typically last from 45 to 90 days.
2. Environmental/ Regulatory
    a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
    b. Agency review and approval required prior to drilling disposal well.
3. Social
    a. No Impact.
4. Technical
    a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug any permeable formation suitable for waste disposal.
    b. Power Supply – Current load is 515 KVA; additional available shore power is 2980 KVA.
    c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

B. Barging:

1. Economic
    a. Purchase/Rent Barges – Facility would need a project dedicated 1,000 BBL barge. Estimated cost for purchase of barge is $150,000 and rental is $500/ day. Estimated cost of tug is $6,000/day.
    b. Trucking – The volume of fluids would require 5 trips per well with an estimated cost of $3,600.
    c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
    d. Disposal – Cost of disposal would be $1,500 per truck. This includes solidification and disposal.
2. Environmental
    a. Air – Increased air emissions from tug operations only would generate 22 lbs of NOx/well, 0.50 lbs of HC/well, 0.26 lbs of PM/well, and 2 lbs of CO/well. This includes the use of one tug

making one round trip at the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.

b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate one additional waste, wash down water, from cleaning the barges and any containers used in transport. The waste water will have to be dispose of in a permitted facility.
c. Mooring – A mooring permit may be required.
d. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.

3. Social
   a. Health – Increased air emissions in non-attainment area
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
   c. Visual – New barge located at platform during drilling activities. Tug and barge traveling through the Santa Barbara Channel during drilling activities.
   d. Political – Oil and gas operations increasing traffic and emissions in the Santa Barbara Channel.
4. Technical
   a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge.
   b. Positioning of barge relative to platform would need to be stable.

C. Drilling Muds & Cuttings Conclusion:

Injection of muds & cuttings will not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.

5. Introducing an additional injection well will reduce power availability for operational flexibility.

Barging drilling muds & cuttings is infeasible due to the following factors:

1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:

1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995).
2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.
3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

DCOR

Discharge Alternatives Study for Platform Edith

Location: Latitude–33° 35.' 45.1" N and Longitude– 118° 8' 26.1" W
Nearest County— Orange
OCS #: P 0296

I. Produced Water

Platform Edith discharges about 368 BBL/day or 134,320 BBL/year. The platform is authorized to discharge 9,000 BBL/day or 3,285,000BBL/year. The current discharge is about 4% of the maximum limit. DCOR will increase injection by about 200 BBL/ day. The additional injection of produced water may be sustainable for a couple of years. This will reduce the discharge to roughly 150 BBL/day or 1% of the maximum permitted discharge.

Discharge	Average [1]Historic Discharge (BBL/Day)	Average Expected Discharge (BBL/Day)	[2]Cumulative Discharge for 2006 (BBL/Year)	Maximum Permitted Discharge Limit (BBL/Year)	Historic Injection (BBL/Day)	Expected Injection (BBL/Day)
Produced Water	368	150	**134,320**	**3,285,000**	550	750

The following alternatives have been considered for injection of water currently being discharged.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Re–injection	Drill well, [3]Optimization, Facilities, Operations	Air, Regulatory	No change	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Mooring, Permit, Spills	Health, Visual, Traffic, Political	Facilities
Pipeline	NA	NA	NA	NA

A. Re–injection of Produced Water:

1. Economic
   a. Drill Well – Injection wells for produced water would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.

[1] Average is cumulative annual discharge/ 365
[2] December 2005 to November 2006
[3] Reconfigure and/ or chemically treat existing injection well or convert existing producer

  b. Optimization – Optimization of existing injection wells and conversion of producing wells to injection will range from $400,000– $800,000.
  c. Facilities – Cost of additional facilities is estimated at $200,000. Increase in pump capacity needed.
  d. Operations – $/bbl charge will increase lease operating expense.
2. Environmental/ Regulatory
  a. Air – Fugitive emissions would occur due to any additional equipment and drilling activities.
  b. Regulatory – There are only two permitted injection wells B-13 and B-15. An additional injection well would have to be drilled an existing injector or producer would have to be optimized. There is a competitive lease line and over injection has the potential to damage or help competitors.
3. Social
  a. No Change.
4. Technical
  a. Geologic – With the injection of produced water a "skin" is developed on the sand face over time caused by natural impurities in the fluid being injected into the formation. As a result of this natural response to injection fluids the formation must be stimulated from time to time to maintain injectivity. This type of interference is observed with an increase of surface pressure. Further more as the injection continues there is a surface pressure constraint that must be monitored as the sand face becomes "clogged" which will require further disposal overboard until stimulation efforts can be completed. The objective of the revitalization efforts is to inject filtered produced water into the formation and slowly increase reservoir the pressure in these two fault blocks. The calculated mobility ratios are about 1.2 and the anticipated time before there is a dramatic increase in water production should occur in 3 to 4 years after initial water injection.
  b. Power Supply – Current load is 233 kVA; additional available shore power is 2750 kVA.
  c. Facilities – Platform production facilities are overbuilt for current production rates and can easily handle more produced fluid.

B. Barging:

Scenario includes a permanent storage barge at the facility plus a transportation barge and tug.

1. Economic
   a. Purchase/Rent Barges – Facility would need a permanent 5,000 BBL barge. Estimated cost for purchase of barge is $105,000 and rental is $1,000/ day. Estimated cost of barge (1,000 BBL) and tug is $4,000/day.
   b. Trucking – The volume of fluids would require 2 trips per day with an estimated cost of $627/ day.
   c. Facilities – Facility would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
   d. Disposal – Cost of disposal would be $5.50 BBL at a total daily cost of $1,320/ day.
2. Environmental/ Regulatory
   a. Air– increased air emissions from tug operations only would generate NOx 357 lbs/year, HC 8 lbs/year, PM 4 lbs/year, and CO 5 lbs/year. This includes the use of one tug making one round trip every 4 days. Additional increases would come from the permanent barge, transportation barge, and trucking.
   b. Waste – sanitary waste and operational waste (tug).
   c. Mooring – Obtain mooring permit.
   d. Permit approval – Modify development and production plan
   e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. While the risk of spills is considered to be small, the increase in the use of tugs/tow boats (2 round trips per week; 104 trips per year) means that this small risk will be increased. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
   a. Health – Increased air emissions in non-attainment area.
   b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic at Terminal Island.
   c. Visual – New barge located next to Platform Edith (140 x 42 x 7). Tug and barge traveling through the San Pedro Bay.
   d. Political – Oil and gas operations increasing traffic and emissions in the San Pedro Bay.
4. Technical
   a. Facilities – Space available for docking barge at Terminal Island. Space for trucking would be needed at Terminal Island.

C. Pipeline:
Platform Edith currently sends its produced gas to Platform Eva and the produced oil to Platform Elly. There is no current water pipeline for this facility. The facility is located 9 miles off the coast of Huntington Beach with no onshore facility available.

D. Produced Water Conclusion:
The ongoing injection of water at the current rate seems feasible for the near future. Injection rates will be increased by another 200 BBL day. However, increasing the water injection rate beyond this or sustaining this injection rate indefinitely will not be feasible due to the following factors:

1. The current water flood scenario expects increased water production within the next 3 to 4 years.

Barging produced water is infeasible due to the following factors:

1. Barging costs would be $725,000/ year. Trucking and disposal costs would be approximately $2,877,900/ year.

Pipelining produced water is infeasible due to the following factors:

1. There is no water pipeline in place at this time.
2. Would not be able to run 9-mile pipeline
3. No onshore facility to except produced water
4. Unlikely neighboring facilities would accept produced water in gross pipeline.
5. Gas line to Eva not feasible.

II. Drilling Muds & Cuttings

Platform Edith could drill up to 20 wells over the next five years. Each well could potentially generate 600 BBL of drilling muds and cuttings. This would be a total of 12,000 BBL of drilling muds & cuttings over the next five years (or 2400 BBL/year). This is approximately 1% of the maximum permitted limit.

Discharge	Historic Discharge (BBL)	[4]Expected Discharge (BBL)	Cumulative Discharge 2006 (BBL/Year)	[5]Maximum Permitted Discharge Limit (BBL/Year)
Drill Muds & Cuttings	0	12,000	0	201,500

The following alternatives have been considered for the disposal of drilling muds and cuttings.

Alternatives	Potential Areas of Impact			
	Economic	Environmental/ Regulatory	Social	Technical
Injection	Drill well, [6]Optimization, Facilities	Air, Regulatory	No Change	Geologic, Power Supply, Facilities
Barging	Purchase/Rent Barges, Trucking , Facilities, Disposal	Air, Waste, Regulatory, Mooring, Spills	Health, Traffic, Visual, Political	Facilities

A. Injection:

1. Economic
    a. Drill Well – Cost of injection well would have a capital cost of $2,000,000 per re–drill and $4,000,000 per new well.
    b. Optimization – To convert existing producer or injector to disposal well would cost $1,500,000 to $2,000,000.
    c. Facilities – Rental of slurification facility would be $7,000/ day. Duration of drilling varies; however, it can typically last from 45 to 90 days.
2. Environmental/ Regulatory
    a. Air – Fugitive emissions would most likely occur due to additional equipment and drilling activities (Reactive Organic Compounds). Emissions from boat and vehicle traffic during equipment moves.
    b. Agency review and approval required prior to drilling disposal well.
3. Social
    a. No change.
4. Technical
    a. Geologic – The solid contents of slurified drilling muds & cuttings are adequate to plug any permeable formation suitable for waste disposal.
    b. Power Supply – Current load is 233 kVA; additional available shore power is 2750 kVA.

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[4] Expected over the next five years
[5] Includes muds, cuttings, & cement (see NPDES permit for breakdown).
[6] Converting existing injector or producer into disposal well

c. Facilities – Facility modifications required for new well. Deck space needed for slurification equipment. Deck space needed for additional injection pumps. Space and storage needed for drilling muds & cuttings from the injection well.

B. Barging:

1. Economic
    a. Purchase/Rent Barges – Facility would need a project dedicated 1,000 BBL barge. Estimated cost for purchase of barge is $105,000 and rental is $500/ day. Estimated cost of tug is $6,000/day.
    b. Trucking – The volume of fluids would require 5 trips per well with an estimated cost of $3,600.
    c. Facilities – Would need to secure adequate space and equipment at harbor. Additional facility modifications required at the platform.
    d. Disposal – Cost of disposal would be $1,500 per truck. This includes solidification and disposal.
2. Environmental
    a. Air – Increased air emissions from tug operations only would generate NOx 357 lbs/well, HC 8 lbs/well, PM 4 lbs/well, and CO 5 lbs/well. This includes the use of one tug making one round trip at the end of each well drilling phase. Additional increases would come from trucking. Approximate trucking distances vary; however, it is expected that trucking distances for a round trip may exceed 400 miles. Air permit modification likely.
    b. Waste – Disposal of cuttings and muds with limited landfill space. Sanitary waste and operational waste from tug operations. Barging wastes to shore will generate one additional waste, wash down water, from cleaning the barges and any containers used in transport. The waste water will have to be disposed of in a permitted facility.
    c. Regulatory – Modification to DPP may be required.
    d. Mooring – A mooring permit may be required.
    e. Spills – Potential spills could result from fueling of the tugs/tow boats or from collisions at sea. The risk of spills is considered to be small. The risk of a spill of the barge cargo is likewise considered to be small.
3. Social
    a. Health – Increased air emissions in non-attainment area.
    b. Traffic (Barge and Truck) – Increased barging traffic in shipping channel and increased vehicle traffic.
    c. Visual – New barge located at platform during drilling activities. Tug and barge traveling through the San Pedro during drilling activities.

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   d. Political – Oil and gas operations increasing traffic and emissions in the San Pedro Bay.
4. Technical
   a. Facilities – Some modifications to the facility will be needed to dump cuttings into barge. Positioning of barge relative to platform would need to be stable.

C. Drilling Muds & Cuttings Conclusion:

Injection of muds & cuttings will not be feasible for the following factors:

1. Costs of new injection well could range from $1,500,000 to $4,000,000 depending on new well or conversion of existing well. Converting an existing well is highly unlikely due to its current operational importance.
2. Slurification equipment is $7000/day. This could total $315,000 to $630,000 per well drilled.
3. Space needed for slurification equipment may not be available.
4. Injection of drilling muds and cuttings into underground formations may not work. These formations may plug rapidly rendering the injection well impotent.

Barging drilling muds & cuttings is infeasible due to the following factors:

1. To dispose of muds and cuttings onshore would cost approximately $80,000 per well.
2. Increase in air emissions would require offsets. These may not be available.
3. Additional waste would be generated from barging activity.
4. Filling up limited land fill space with non-hazardous material (CSA 1985).

Evaluation of environmental impacts:

1. The environmental impacts of discharging water-based muds and cuttings to the ocean are relatively benign. The fine particles (e.g., clays) and fluids are swept away and diluted by the currents, while the coarser cuttings particles will fall to the sea floor. The toxicity of the suspended particulate phase of generic drilling mud has been tested and found to be practically nontoxic (i.e., LC 50 >10,000 ppm) (CSA 1985). Benthic organisms may be smothered by the fallout of the coarser particles onto a relatively small area of sea floor, but the cuttings pile combined with the debris from epibenthic organisms on the platform structure forms a "shell mound," which has been found to be beneficial habitat for a variety of invertebrates and fishes (Love, Schroeder, and Nishimoto 2003). Studies designed to assess the effects of drilling discharges from offshore platforms found no long-term impacts (SAIC and MEC 1995).

2. On the other hand, as discussed above, barging of these muds and cuttings would have negative impacts with regard to increased air emissions, additional wastes, and land fill impacts.
3. While injection of muds and cuttings would have the least environmental impact, the high cost, platform space limitations, and probability of quickly plugging the receiving down-hole formation (thus preventing the receipt of additional material) renders this option impractical.

1.6 References

Continental Shelf Associates, Inc. (CSA) 1985. Mitigation Measures for Drilling Discharges from California Offshore Production Platforms. Draft Final Report for the California Coastal Commission Study. 1 April 1985. 210 p.

Love, M.S., D.M. Schroeder, and M.M. Nishimoto. 2003. The Ecological Role of Oil and Gas Production Platforms and Natural Outcrops on Fishes in Southern and Central California: A Synthesis of Information. U.S. Dept. of the Interior, U.S.G.S., Biological Resources Div., Seattle, WA 98104. OCS Study MMS 2003-032.

SAIC and MEC. 1995. Monitoring Assessment of Long-Term Changes in Biological Communities in the Santa Maria Basin: Phase III, Final Report. Report submitted to the U.S. Dept. of Interior, Minerals Management Service/National Biological Service, under Contract No. 14-35-0001-30584.